



Chapter One: The Water Resource Management Plan

The purpose of this Water Resource Management Plan is to guide and support the National Park Service's decision-making process as it relates to the protection, conservation, use, and management of Cape Cod National Seashore's water resources. The Cape Cod National Seashore Water Resource Management Plan is intended to provide guidance for management decisions for the next decade by: 1) providing an analysis of existing information, and 2) recommending preferred actions that will increase ecosystem knowledge to resolve uncertainties and conflicts. This water resource management plan will evaluate what is known and chart a cost-effective course toward learning what is unknown.

A New World Discovered

One of the first "known" environments in the New World, the outer or lower Cape is still imperfectly understood by scientists, managers and planners intent on understanding its special nature. Cape Cod, Massachusetts and the Cape Cod National Seashore (Figure 1.1) are a naturally complex environment, created by glaciers and subject to natural change caused by storms, fires and droughts. Nature, through these and other dynamic processes, has created a place which people enjoy. People visit the National Seashore because it preserves a portion of the Cape in its near natural state, providing opportunities for hiking, biking, photography, sightseeing, boating, fishing, hunting, beach combing, birding, and other recreational uses.

Partners in Conservation

In 1961, approximately half of the land mass of the outer Cape was granted national park status and named the Cape Cod National Seashore (Appendix A). It encompasses 44,600 acres of which 16,900 acres are water. The National Park Service manages 26,031 acres with the remaining 18,569 acres within the National Seashore boundary consisting of interspersed private and public lands in six established Massachusetts communities, the towns of Chatham, Orleans, Eastham, Wellfleet, Truro, and Provincetown (Figure 1.2). The Cape Cod National Seashore set national precedence by incorporating residents into the land management process through what is referred to as the "Cape Cod Formula". Establishment of Cape Cod National Seashore set in motion not only a process of resource

Figure 1.1: Regional Location and Cape Cod National Seashore Boundary

Sources: shorelines and boundaries from USGS DLG data (1977) with updates from aerial photos (1991)

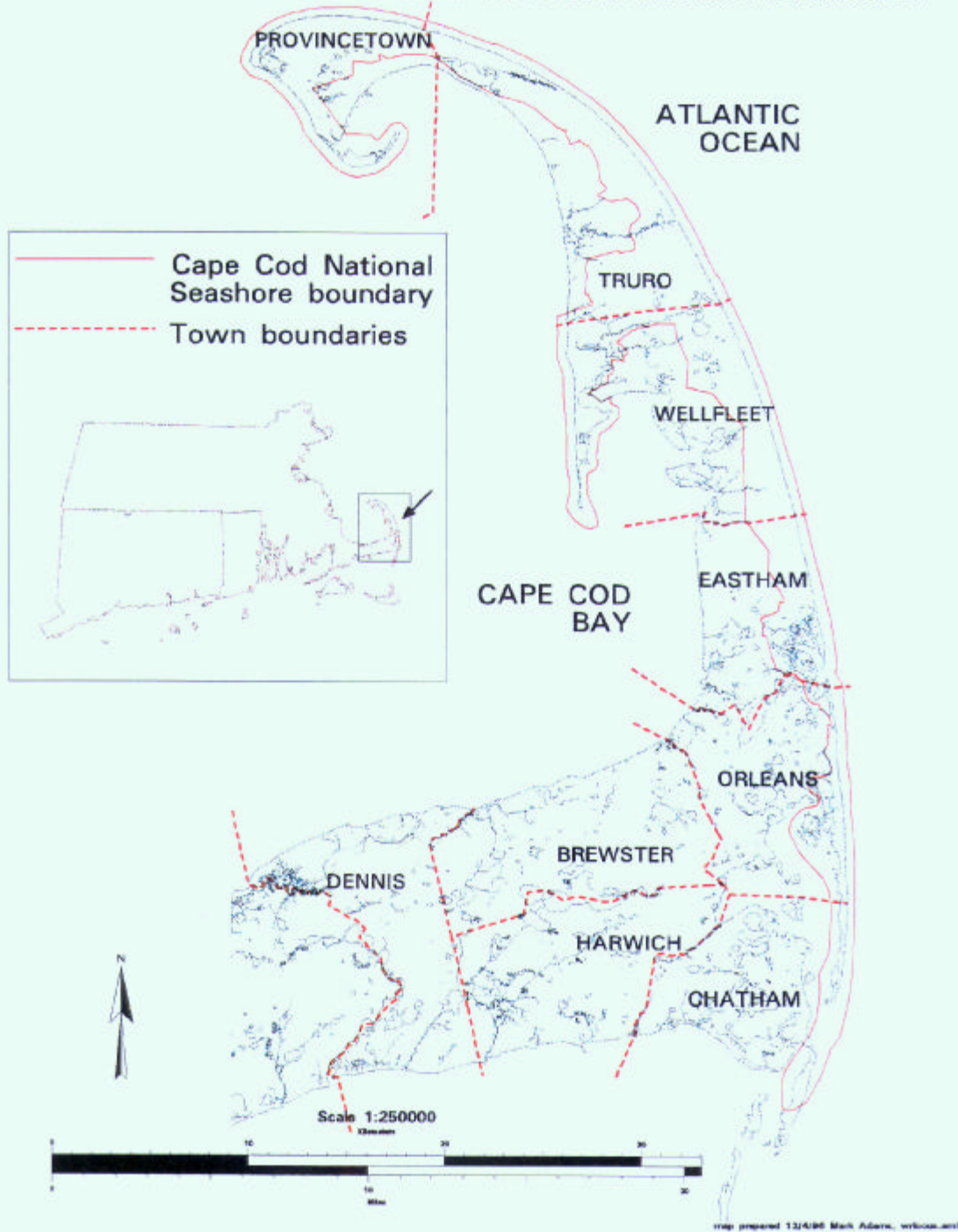
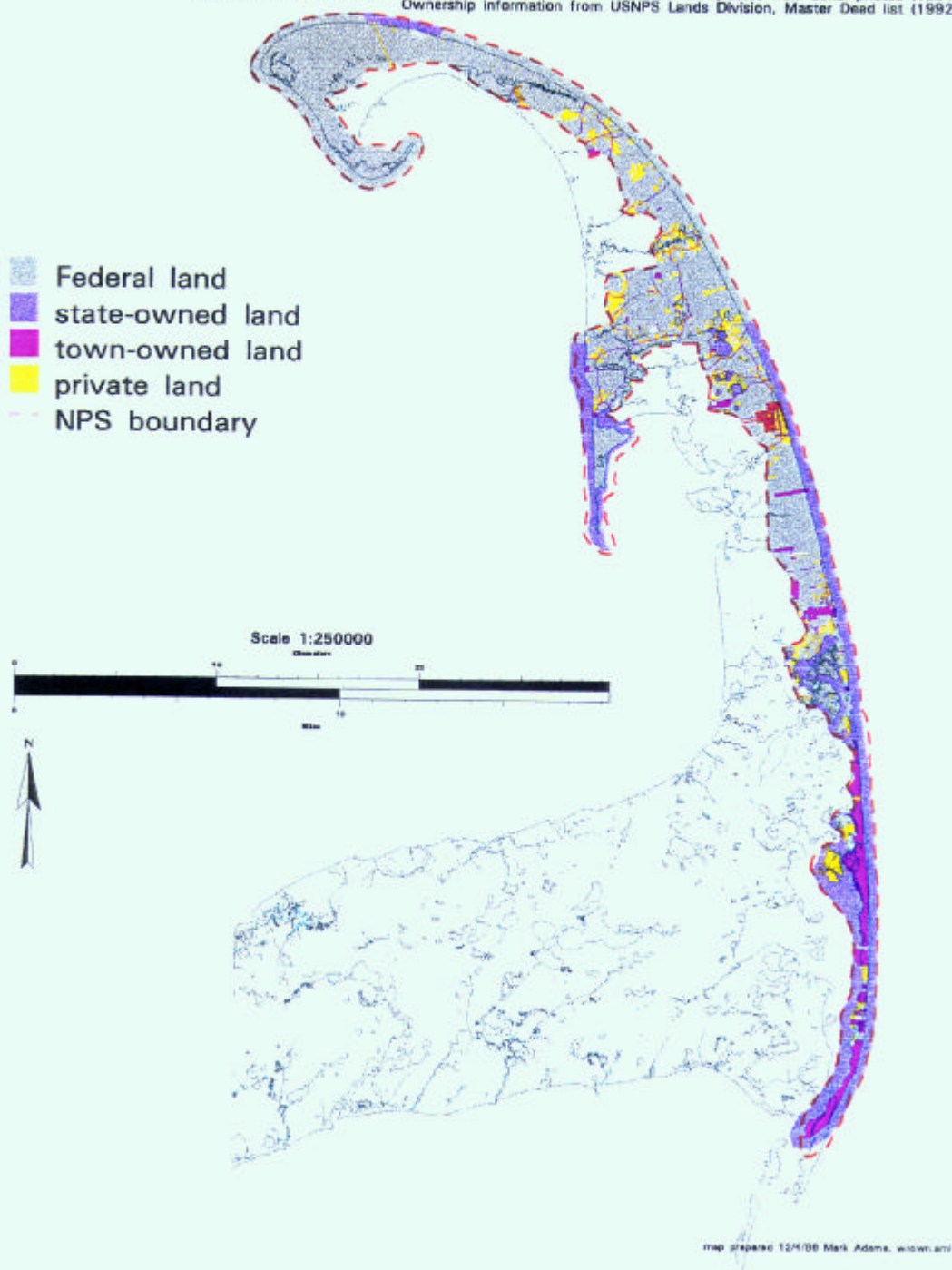


Figure 1.2: Land Ownership within NPS Boundaries
Cape Cod National Seashore

Sources: shorelines and boundaries from USGS DLG data (1977) with updates from aerial photos (1991)
Ownership information from USNPS Lands Division, Master Deed list (1992)



The Water Resources Management Plan will provide the basis for:

- **understanding the hydrologic character and aquatic biota of the National Seashore;**
- **mitigating pollutant impacts from within and outside the National Seashore;**
- **cooperating in management with neighboring communities and other agencies and organizations over uses of water resources located within the National Seashore and those outside the Seashore with influence on resources within the park;**
- **protecting naturally occurring aquatic communities and the public health;**
- **resolving jurisdictional questions over the National Seashore's water resources; and,**
- **integrating water resources management with daily National Seashore operations and future planning.**

protection and conservation, but also a mechanism for community participation, thus making the residents of the outer Cape stakeholders in the conservation of their own lands. The partnership formed between the residents, local governments and the National Park Service now offers great opportunities as well as challenges in the use and protection of natural resources.

The Original Water Resources Management Plan — 1981

The Cape Cod National Seashore published the Analysis of Water Resource Management Alternatives in 1981 as part of a larger process to complete a Water Resource Management Plan (Mitchell and Soukup, 1981). The report was written to encourage public participation in the review of suggested water resource management alternatives. The document was also intended to clearly illustrate the water resource management goals of Cape Cod National Seashore for the public.

The issues covered in the 1981 document were ground water quality and quantity, kettle ponds, Gull Pond Sluiceway, Pilgrim Lake, water and marsh areas near the Herring River Dike, and wetland protection. All of these management issues are relevant today, presenting many of the same challenges that existed in 1981.

The preface for the 1981 document states that, "In some cases, the management objectives of the National Park Service may not completely coincide with the objectives of all other Cape groups and citizens; however, there are also many common objectives for the preservation of the outer Cape's water resources" (Mitchell and Soukup, 1981, p. ix). This statement is

true today as well. In 1981, the report on water resources served as a tool for communication between the public and the National Park Service. The 1999 Water Resources Management Plan is not only a tool for communication, but also an action plan for public involvement in the protection of the Cape's freshwater resources.

The Challenge

The federal mandate of the National Seashore encompasses two conflicting goals of resource protection and public access. Cape Cod National Seashore must exist with the apparent contradiction between serving as a major attraction to people and protecting the National Seashore lands and waters in as natural a condition as possible. These conflicting goals pervade a wide range of issues from beach access to ground water use. This conflict has become increasingly pertinent as Cape Cod has come under enormous development pressure in the past two decades. Most of that pressure has occurred on the upper Cape towns located west of Chatham in Barnstable County, but demographic trends suggest that the pressure will increase on the outer Cape (see Figure 1.2), in part because of the existence of the Cape Cod National Seashore.

Due to these circumstances, the Cape Cod National Seashore Water Resources Management Plan must reconcile opposing pressures by identifying alternatives and recommending actions that protect the characteristics of the water resources.

General Management Objectives

The following are management objectives (National Park Service, 1998) that reflect the

enabling legislation of Cape Cod National Seashore (Public Law 87-126) and its mission to protect the natural resources of the National Seashore while enabling the public to gain a greater appreciation for the environment.

1. Seek to understand, foster, and maintain native biological and physiographic diversity to sustain thriving, dynamic natural communities and systems. Within these standards, protect water resources through a cooperative, balanced approach to water use management.
2. Encourage commitment to the stewardship of the buildings, places, activities, and artifacts of Cape Cod that best exemplify its traditional character, and conserve them to ensure their continuing contribution to the culture of Cape Cod, in collaboration with local communities.
3. Allow natural processes to continue unimpeded in natural zones, including the action of wind and water, and neutralize the effects of human intervention where it has adversely affected natural systems.
4. Provide opportunities for a diverse range of quality experiences that are based on the resources and values of Cape Cod, with consideration for sustainable practices, traditional uses, and the purposes of the National Seashore.
5. Stimulate and then satisfy a public desire to understand the natural and cultural resources and the history and sociology of Cape Cod through the primary interpretive themes identified for the National Seashore.

6. Collaborate with local communities and other stakeholders to address common issues and to promote a stewardship ethic for the National Seashore.

Water Resources Management Plan Objectives

Consistent with the above National Seashore General Management objectives, the Water Resources Management Plan has two goals: 1) the protection of ground and surface water quality and quantity as well as adjacent wetlands, and 2) restoration of the natural hydrography and estuaries in consultation with affected municipalities. These goals will be accomplished through the following objectives:

1. to provide a detailed survey of existing information on the National Seashore's water resources;
2. to identify and discuss current and potential water resource problems and issues;
3. to clarify the legislative mandates of the National Park Service in the context of operation within the local and regional frameworks;
4. to improve and encourage communication with appropriate local state and regional agencies;
5. to identify and discuss viable actions addressing water resource management issues; and,
6. to develop an overarching water resources program.

Relationship to Other Planning Efforts

Many water resource management issues are a direct result of the complex pattern of multiple land ownership within the National Seashore and the activities that occur on and adjacent to these lands. The following is a

brief description of other planning efforts or plans on the lower Cape that could have an effect on the management of water resources on the National Seashore.

Lower Cape Water Management Task Force

The task force, formed in 1992 comprises members from the Cape Cod Commission, Cape Cod National Seashore, and the towns of Eastham, Wellfleet, Truro, and Provincetown and is working towards a long term plan for the sustainable use of ground water resources. The primary goal of the Task Force "is to provide a decision-making tool which contains information, options, and recommendations regarding water supply planning for the region and respective towns" (Sobczak and Cambareri, 1996). Since the hydrological environment does not recognize political boundaries, the Task Force has examined water supply options from a resource-based perspective, using hydrological boundaries only. The Task Force report, released in 1996 (Sobczak and Cambareri, 1996), includes well location suitability, current and projected water use, current and projected water quality data, and cost information associated with the addition of wells and distribution systems.

Cape Cod Commission Regional Policy Plan

This plan outlines the regulations and minimum standards set for water quality within Barnstable County. The Cape Cod Commission presents this information for the use of town governments on the lower Cape (Cape Cod Commission, 1991).

Provincetown Master Plan

The 1988 Provincetown Master Plan addresses the problem of growth management and how it relates to adequate water supplies. Recognizing the need to limit growth in the area, the plan states that the goal of Provincetown is to live within the limits of the town's resources. Specific to the National Seashore, Provincetown's plan addresses water quality and quantity issues (Town of Provincetown, 1988).

Truro Comprehensive Plan

The water resources section of the Truro comprehensive plan highlights the role that the town intends to play in the area of water quality. The goals target ground water protection and sustainable withdrawal of ground water supplies. The plan (Town of Truro, 1994) outlines Truro's water resource policies which are in accordance with the Cape Cod Regional Policy Plan.

Wellfleet Local Comprehensive Plan

The Wellfleet Local Comprehensive Plan (Town of Wellfleet, 1996) highlights water resources. An inventory of all water resources within Wellfleet is described which includes 13 kettle ponds located within the National Seashore. Goals and policies that relate to water resource management target wellhead protection areas, recharge areas, impaired areas, and potential water supply areas. Non-point source pollution threats to water resources are discussed and an implementation program for management is summarized.

Eastham Comprehensive Plan

This plan (Town of Eastham, 1996) outlines Eastham's goals for meeting minimum performance standards, which are modeled primarily after the Regional Policy. Issues concerning land use, growth management, and

natural resources are addressed. The natural resources section highlights water resource protection and management. Wellhead protection, contaminated areas, recharge areas, and potential water supply areas are discussed also in this section.

Identification of Water Resource Issues

Six water resource issues provide the focus of this Water Resource Management Plan. The list of issues was derived from meetings between the National Park Service staff and University of Massachusetts planning team as well as from many past meetings between the National Park Service and the public. The issues are: 1) ground water withdrawal impacts; 2) water resource contamination from non-point sources; 3) confirmed and potential contamination sites; 4) recreation impacts to pond water quality; 5) Cape Cod National Seashore infrastructure; and, 6) impacts of diked estuaries. These six issues are summarized in this section and discussed in detail in chapters five through ten. In addressing these issues, the park is provided with a means to holistically approach the resolution of present conflicts. Selection of these six issues for principal focus does not presume that other issues do not or will not have importance. Elements of this plan provide a mechanism to address other issues.

Issue 1: Impacts of Ground Water Withdrawal

The majority of the available fresh water on the lower Cape is ground water. The ground water resource directly supports most of the lower Cape's surface waters - ponds, streams and wetlands. The human populations of the lower Cape are also entirely dependent on the ground water for private and municipal water supply. For this reason, the U.S. Environmental Protection Agency has

designated this water source a “sole source aquifer” and must review any federally funded projects within the aquifer’s watershed. The “sole source” designation is granted on the basis of a water supply source being needed to supply greater than 50 percent of the drinking water to its service area where there is no reasonable alternative should the source become contaminated (Massachusetts Department of Environmental Management, 1994).

Population and housing density increases in lower Cape communities have increased demand and simultaneously degraded local ground water quality to the extent that some communities are considering new public supply well locations. Since the National Seashore occupies a large percentage of the lower Cape land area and contains protected open space, National Seashore lands are often viewed as prime sites for withdrawing high quality drinking water. It is a delicate issue to balance water supply needs against a park mandate to protect all natural resources, including the ground water resources vital to maintaining surface water ecosystems (Sobczak and Cambareri, 1996).

Large-scale ground water withdrawals change the local water balance and the rate and pattern of ground water flow, resulting in impacts to ground water dependent ecosystems (Martin, 1993). There are three primary ground water withdrawal concerns facing the National Seashore as development continues and the demand for new private and public water wells increases. First, excessive ground water withdrawals can lower the local water table, potentially depleting pond, wetland, and vernal pool water levels. Second, large-scale, sustained pumping can decrease aquifer discharge, impacting streams and estuaries. Finally, under extreme cases,

the ground water volume may be depleted to a point where salt water intrudes and contaminates the fresh ground water (Sobczak and Cambareri, 1995). The combination of an extremely vulnerable sole source water supply and the rapid growth rate on the lower Cape makes for a serious situation and requires a comprehensive resource protection and management program (Zoto, 1988).

Issue 2: Water Resource Contamination from Non-point Sources

The National Seashore as well as the Commonwealth of Massachusetts and local Cape Cod agencies recognize that contamination of water resources by septic system leachate poses a great threat to the long-term health of the hydrologic environment of the Cape. There needs to be a balance between the human impacts of development and the health of the environment. On the lower Cape, homes and businesses generally rely on private septic systems for wastewater disposal. Ponds, estuaries, and ground water can all be degraded by pollutants that come from septic effluent. For almost two decades, various reports have documented increases in nitrate concentrations in the ground water on the lower Cape and have directly linked the elevated levels with increases in housing density and the number of actively used on-site septic systems (Frimpter and Gay, 1979; Persky, 1986; Noss, 1989; Goetz et al., 1991; Cambareri and Sobczak, 1995). The Massachusetts Department of Environmental Protection has documented that faulty private septic systems are the largest contributor of pollutants to inland and coastal surface water bodies in the state (Sit, 1995). Careful land-use planning and multi-jurisdictional cooperation are necessary to mitigate this problem.

Another significant source of non-point pollution is acid deposition. Cape Cod ponds are naturally very low in pH and therefore acid neutralizing capacity. Forty percent of Barnstable County ponds have little to no acid neutralizing capacity, a higher percentage than any other county in Massachusetts (Godfrey et al., 1996). Despite reductions in acid deposition in New England since the late 1980s, pond pH's on the lower Cape have not significantly changed. Although a survey of mercury in National Seashore ponds has not been completed, preliminary results and a statewide survey have shown a strong relationship between low pH and elevated methyl mercury levels in fish tissue.

Road runoff, including salt and petrochemicals, as well as surface runoff and infiltration from lawns and golf courses may also be important sources of contamination. These non-point sources are presently a minor threat, but may become significant with increased development of the outer Cape.

Issue 3: Confirmed and Potential Point-Source Contamination Sites

Inorganic and organic pollutants derived from landfills, leaking underground storage tanks, septic effluent, and urban runoff on the lower Cape pose a serious threat to clean drinking water and to ponds, rivers and estuaries located within the National Seashore. The intimate connection between the Cape's ground water and surface water compounds the difficulty of managing these problems, as does the permeability and generally poor contaminant adsorption characteristics of the region's sand and gravel aquifer. There are five landfills located on the lower Cape, all of which have the potential to impact the freshwater resources within the National Seashore. According to past research reports, some surface waters both inside and outside

the National Seashore may have already been degraded (Cambareri et al., 1989; Frolich, 1991; Urish et al., 1993; Winkler, 1994).

Issue 4: Cultural Impacts on Pond Water Quality and Biota

Nearly all of the 20 kettle ponds located within the National Seashore boundary are used for recreation. Shoreline erosion and historic fisheries management, including stocking and liming, have affected pond waters. For example, an anadromous fish run between Gull Pond and Higgins Pond is maintained by artificial means to promote recreational fishing; however, the impacts of this are unknown. On some shorelines, rare plants have been affected by foot traffic.

While many pond management issues are obvious, management authority is not. There are several agencies and many landowners that have some control over access and management. A coordinated system for multi-jurisdictional management has not yet been established.

Issue 5: Cape Cod National Seashore Infrastructure

The infrastructure of the National Seashore is susceptible to the same inefficiencies experienced elsewhere. It is important that the National Seashore serve as a premier example of pro-active thinking and improves its facilities to reflect the goals and objectives stated in this Water Resources Management Plan. Analyzing ages and types of septic systems as well as the amount of use that each facility receives is essential to determining the efficiency of the park's water usage. Also, there are private properties within the boundary of the National Seashore that have underground storage tanks and septic systems that can add to the contamination threats within the park. Management of these

properties is important to the preservation of many park resources. Additionally, non-point source pollution within the National Seashore needs to be identified and managed in order to ensure the long-term health of the hydrologic environment.

Issue 6: Ecological Impacts of Tidal Restriction

The importance of salt marsh estuaries to the Cape Cod National Seashore as a primary natural resource feature has been highlighted continuously in the 35-year administrative and legislative history of the park (National Park Service, 1998). Since the early 1900s, intertidal and estuarine resources on the Cape have been greatly altered, turning brackish waters with a marine influence into freshwater wetlands and upland habitats as is the case at Herring River, Pamet River, Hatches Harbor, and Pilgrim Lake. It is estimated that diking affects over 10 percent of the remaining coastal marshes in New England as well as a portion of nearly all the salt marshes on the lower Cape (National Park Service, 1998). Salt marsh diking degrades and eliminates estuarine habitat for many native plant and animal species, including fish, shellfish and crustaceans with economic and recreational value. Restoration has been proposed for each of these diked areas; however, development within the diked areas makes restoration more complicated. Partial or complete tidal restoration could re-establish native estuarine environments.

Management Strategy

Many issues regarding the use of water resources have developed since the formation of Cape Cod National Seashore in 1961. These six issues represent management challenges that have been relevant since then. These issues can also be found in several other

plans from local governments and the Cape Cod Commission, as well as in 1981 National Park Service report on water resource management alternatives (Mitchell and Soukup, 1981; Town of Truro, 1994; Sobczak and Cambareri, 1996; Town of Eastham, 1996; Town of Wellfleet, 1996; Town of Provincetown, 1988). This plan recognizes that in order to move forward on many of these issues, there needs to be a cooperative framework for management in the area of water resources. Committing to water resource management expertise at Cape Cod National Seashore is a vital component of this framework. However, this endeavor can be strengthened through the participation of lower Cape towns and Cape residents and visitors in water resource programs, such as water quality sampling and ongoing discussions concerning water quality and quantity. There needs to be close integration of water resources management with understanding of the natural resources and the people of the Cape. Thus, this plan continues the spirit of the Cape Cod Formula, supporting a cooperative relationship into the future.

An Action Plan for the Future

This Water Resources Management Plan focuses on the protection of outer Cape freshwater resources including ponds, ground water, and estuaries. These water resources are used by humans for drinking water and recreation and support the native biota. Residents of the outer Cape, both within and outside the National Seashore, are a focal point of this plan. Without their cooperation and participation, effective management of water resources is impossible.

For this reason, this plan proposes the establishment of a water resources management program which includes

residents and local governments to effectively manage water resources on the outer Cape. The four components of this program are:

- a cooperative forum among the local government agencies and the National Park Service for water management decisions;
- a community extension program that involves the public in education, research and planning;
- data management that improves the accessibility of information regarding water resources; and,
- a research program that increases knowledge of the water resources on the National Seashore.

The implementation of the water resource management program has been broken down into three time periods: 0 to 400 days, 400 days to 5 years, and 5 years to 10 years. The first 400 days provides the National Park

Service with time for planning and organizing before implementation begins. Actual implementation and execution of the water resources management program should occur between 400 days and 5 years. Specific actions are discussed in the plan with their corresponding management issue. For example, the portion of the program related to septic systems is included in Chapter Six. During this time, research and community projects will begin. In the final 5 to 10 year time period, the program will continue activities related to water resource management, specifically the research projects that require several years to complete. These research activities, as well as all proposed actions, are described fully in project statements listed in Chapter Eleven.

First 400 Days of the Water Management Program

Develop a consistent policy to guide complex choices. The initial step would be a review of founding legislation and existing policy in other parks with comparable problems. The second step would be a review of current policy and practice by the National Seashore and others involved in management of Cape Cod resources.

Establish a committee that includes the Cape Cod National Seashore, Cape Cod Commission, Massachusetts Coastal Zone Management, six towns in the National Seashore, Massachusetts Department of Environmental Protection, Massachusetts Divisions of Marine Fisheries and Fisheries & Wildlife, and Massachusetts Audubon. This committee represents all parties that have a stake in future water resource management on the outer Cape including those with governmental jurisdiction. The first goal is to develop a memorandum of understanding between all the agencies that acknowledges the need for management efforts that complement each other. The agreement should focus on developing a consensus for sustainable management and should holistically consider the short-term and long-term impacts on the development of water resources.

Begin community extension work to involve residents in water resource protection. Hold a workshop with the Massachusetts Water Resources Authority on water quality and consumption issues. The National Seashore should be a participant but not a leader in this workshop. A group of residents and representatives from the National Seashore should be established to develop a newsletter as a tool for communication between the National Seashore and the residents and visitors of the outer Cape. Develop an action plan that involves residents in management and/or research activities, e.g. water sampling, education, and water use monitoring. Environmental education is a critical part of water resource protection. The current environmental education program presented to local schools should be evaluated and revised to emphasize a water resource protection component.

Develop a comprehensive water resource database that is manageable, consistent and compatible with other National Park Service databases. This database should consolidate data into a format that is easily retrievable and easily updated. The plan for the database should include geographic information system data layers as well as U.S. Geological Survey water sampling data, National Park Service research and monitoring data sets, and park facilities monitoring data.

Research and planning projects should be prioritized and funding secured on the basis of the project's priority. Projects should be discussed and prioritized by the Cooperative Program Committee. An evaluation should be made to determine what is currently being done by all agencies and what role the National Park Service can play in existing projects.